

# A DATABASE APPLICATION FOR DONOR-RECIPIENT HLA MATCH USED IN KIDNEY TRANSPLANTATION

Zhou Guohong

Dept. of BME, Capital University of Medical Sciences, Beijing,100054, P.R.China

**Abstract** -The outcome of kidney transplants from unrelated live donors or from cadaver kidneys have been reported to be strongly influenced by HLA compatibility. Due to the difficulty of allocation of kidneys for identical HLA match, to increase patients' chances of receiving transplants, consequently, matching has been proposed of deduced amino acid residues of the individual HLA molecules shared by cross-reactive antigen groups(CREGs). Currently many hospitals in China use serological method for HLA typing, some of them use DNA based technology for HLA typing. But most hospitals in China perform HLA matching manually. We have developed a database application system with a program which can quickly find the most suitable individuals in need of kidney transplants from the waiting list for an available donor. Besides 0-3 mismatch of HLA-A,B, and DR, the program works with a criteria of CREGs and permissible HLA-DR mismatch. We noticed some different definitions of CREGs in the literatures and some divergence of views about permissible mismatch concept, it is also our goal to evaluate above criteria with statistical clinical results. Our system also covers virtually all aspects to meet the requirements of most hospitals' urological departments. Its features include patient information management, various statistical reports, and so on. Currently it is in use at two famous hospitals in China.

**Keywords:** HLA match, CREG, kidney transplant

## 1. INTRODUCTION

Tissue typing is the detection of antigens on the surface of lymphocytes. These antigens make up the HLA (Human Leukocyte Antigen) system. The true function of the HLA system is that HLA antigens restrict and therefore regulate the immune response in a highly specific way. It is widely discussed in the literatures about the roles and criteria of HLA matching in transplantation<sup>1</sup>. To debate with the view point that HLA matching in kidney transplantation from unrelated live donors is superfluous, Gerhard Opelz<sup>2</sup> analyzed the influences of HLA matching on the outcome of 2281 transplants from unrelated live donors from 1986 to 1995 at 198 transplant centers, and concluded that the effect of HLA compatibility on graft outcome is strong and statistically highly significant. Some other authors' studies indicated that HLA matching should be a main factor in the allocation

of kidneys from cadaver donors. In general, many statistical studies indicated that a better HLA match between donor and recipient leads to a better graft and patient survival rates.

To quickly find the most suitable individuals in need of kidney transplants from the waiting list for an available donor, we have developed a database system that will meet the requirements of most hospital's urological departments in China. Besides identical HLA match, the program works with a criteria of CREGs and permissible HLA-DR mismatch.

Although there is controversy over the permissible mismatch concept<sup>3</sup>, our program's algorithm is subject to change if a more authorized criterion is published in literatures or found by our own evaluation.

## 2. MATERIALS AND METHODS

The program contains the following functional aspects: 1. User login interface: different user should have different limits of authority. Super user can perform the following tasks: adding a new user, deleting a user, modifying password.

2. Patient registration interface: entering a new patient record, browsing, editing, deleting a record, records for pre-operation test, records for during operation tests.

3. HLA matching: entering, browsing, editing, deleting a donor's/recipient's record; searching recipient records from waiting list to match a specific donor; display or print search result.

4. Post-operation testing records.

5. Statistics and various reports.

To use this program, both the donor and recipient of a transplant had to be typed for the HLA-A, -B and -DR loci by serological techniques. Donors' and recipients' HLA data should be entered into our database from a friendly user interface. The HLA matching program works with the following algorithm: First, select a donor's record from the donors' list, then click a button, the program will display search results in a few seconds. The program offers two options: (1)Identical match; (2)CREG or permissible mismatch.

For identical match, the program gives three groups of search results: (1) 0 1 A,B,DR mismatch(MM); (2) 0 2 MM; (3) 0 3 MM. Select option 2 will get the following three groups of results: (1) 1DR identical match, 5 other antigens belong to CREG (A,B) or permissible mismatch

## Report Documentation Page

<b>Report Date</b> 25 Oct 2001	<b>Report Type</b> N/A	<b>Dates Covered (from... to)</b> -
<b>Title and Subtitle</b> A Database Application for Donor-Recipient HLA Match Used in Kidney Transplantation		<b>Contract Number</b>
		<b>Grant Number</b>
		<b>Program Element Number</b>
<b>Author(s)</b>	<b>Project Number</b>	
	<b>Task Number</b>	
	<b>Work Unit Number</b>	
<b>Performing Organization Name(s) and Address(es)</b> Capital University of Medical Sciences Dept. of BME Beijing, 100054, P.R. China		<b>Performing Organization Report Number</b>
<b>Sponsoring/Monitoring Agency Name(s) and Address(es)</b> US Army Research, Development & Standardization Group (UK) PSC 802 Box 15 FPO AE 09499-1500		<b>Sponsor/Monitor's Acronym(s)</b>
		<b>Sponsor/Monitor's Report Number(s)</b>
<b>Distribution/Availability Statement</b> Approved for public release, distribution unlimited		
<b>Supplementary Notes</b> Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. , The original document contains color images.		
<b>Abstract</b>		
<b>Subject Terms</b>		
<b>Report Classification</b> unclassified	<b>Classification of this page</b> unclassified	
<b>Classification of Abstract</b> unclassified	<b>Limitation of Abstract</b> UU	
<b>Number of Pages</b> 3		

(DR); (2) 1DR identical match, 4 other antigens belong to CREG (A,B) or permissible mismatch (DR); (3) 1DR identical match, 3 other antigens belong to CREG (A,B) or permissible mismatch (DR). HLA antigens present in the donor but absent in the recipient were counted as mismatches. About CREG, we referenced a CREG table published by South Thames Tissue Typing Center. About Permissible mismatch, we referenced a table published by Etsuko Maruya, Steve Takemoto, and Paul I, Terasaki<sup>4</sup>.

3. RESULTS

The system covers virtually all aspects to meet the requirements of a urological departments. It includes patients' registration, donor- recipient HLA match, records of patient test history, and statistical functions. It also can produce a multiple of common reports. Figure 1 is the user interface for patient registration. It contains four pages: patient's ID and common information, records of patient test before operation and during operation, and patient records browsing. The HLA-phenotypes of the patient and the donor also should be entered here.

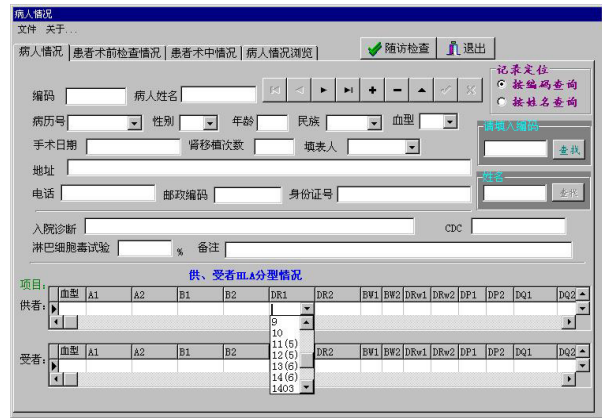


Figure 1. User interface for patient registration.

After clicking on a button at the top of this interface, the patient test history interface appears(see figure 2). Kidney- transplanted patients should be tested regularly, and kept the testing records in the database, those records can be used for patient treatment, and also for statistical analyzing purpose.

By clicking a button of "HLA matching" from the main window of this program, the HLA matching window is presented. This window contains three pages: recipient list, donor list, and matching results. The HLA-phenotypes of each recipient and each donor should be

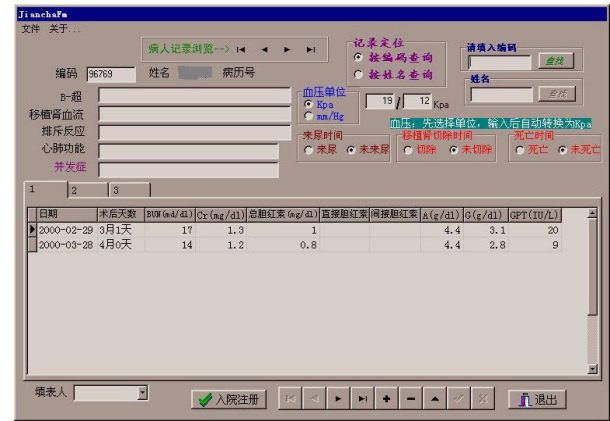


Figure 2. User interface for patient test history.

entered here. Every antigen's data could be entered easily just by clicking the corresponding field and then select an item from the pop-down list. Click the button at the bottom-right corner of the donor page, the option menu will indicate. Select a choice, then click the OK button, the program searches the suitable recipients who with the selected donor are met the HLA matching criteria stated in the METHOD section. After a few seconds, three groups of searching results show on the third page of HLA matching window (see figure 3).

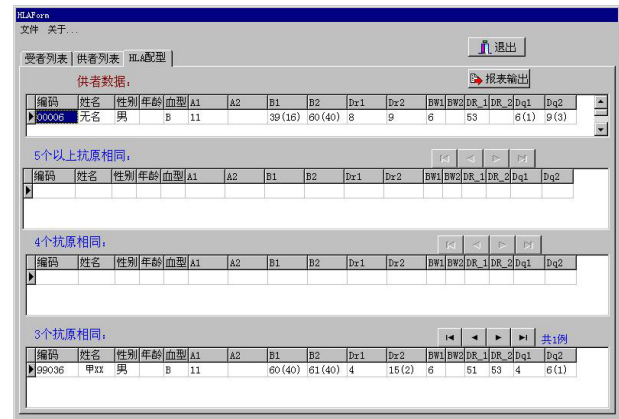


Figure 3. HLA matching results.

HLA matching program produces a multiple of common reports including: monthly PRA report; recipient list; donor List; transplants done this year; patient test history.... It also includes the HLA matching results. Figure 4 presents an example of such a report. This program is currently in use at two famous hospitals in China.

<div> <div>Print Preview</div> <div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div> <div>Close</div> </div>														
<div> <div>供、受者HLA配型情况</div> <div>供者HLA数据:</div> </div>														
00004	倪国平	男	O	11	30(19)	13	55(22)	4	17(3)	6		51	53	
<div> <div>供、受者HLA配型情况</div> <div>3个抗原相同:</div> </div>														
00082	刘庚生	男	58	A	11	13	55(22)	11(5)	15(2)	6	6(1)	7(3)	51	52
00083	黄金胜	男	61	A	2	24(9)	13	55(22)	4	12(5)	6	7(3)	8(3)	52 53
00132	邱瑞康	男	54	A	30(19)	33(19)	13	58(17)	7	17(3)	4	2	52	53

Figure 4. A report of HLA matching results.

4. DISCUSSION

Currently, the data format of our program is suitable for serological HLA typing. Later on we shall improve our program to manage HLA typing result both from serological and DNA methods.

ACKNOWLEDGMENTS

The author thank the urological department of Chao Yang hospital, Beijing, China and a military hospital in Guang Zhou, China for providing patient follow-up data and acting as serious, enthusiastic users of this software.

REFERENCES

1. PI. Terasaki, JM. Cecka, DW. Gjertson, S. Takemoto, "The role of HLA typing in clinical kidney transplants, 30 years later: indisputable fact regarding clinical organ transplantation [Editorial]. *In Terasaki PI, Cecka JM, Clinical transplants 1992. Los Angeles: UCLA Tissue Typing Laboratory*11, 1993: 442.
2. G. Opelz, "Impact of HLA compatibility on survival of kidney transplants from unrelated live donors",*Transplantation*11, Vol. 64, No. 10, 1997.
3. T. Wujciak , G. Opelz, "Evaluation of the permissible mismatch concept", *Transplant 9 (Suppl 1)*11:8-10, 1996
4. Etsuko Maruya, Steve Takemoto, and Paul I, Terasaki, "HLA Matching: Identification of Permissible HLA Mismatches".*Clinical Transplants*11. 1993.